

GÉANT Strategy and services

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www.geant.org



To support collaboration and development amongst researchers, the dissemination of information & knowledge, and provide access to a portfolio of services and infrastructure resources:



Runs a membership association for Europe's National Research & Education Networks (NRENs) GÉANT Association



Coordinates and participates in EC-funded projects

Under Horizon 2020 the financial instrument for implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness



Operates a pan-European e-infrastructure GÉANT network



Manages a portfolio of services for research & education EduX



Organises and runs community events & working groups TNC, task forces & special interest groups





Membership Association

GÉANT Association supports and represents over 40 NRENs across Europe.

Together they support over 10,000 institutions and 50 million academic users.







Bulk of Income (55%) from European NRENs subscriptions Consortium subscriptions 43% funded by EC

Direct income from EC Project coordination and participation in EC projects

Membership fees to GÉANT Association NRENs & commercial partners

Revenue from providing bespoke services to R&E community

- Consortium subscriptions based on complex cost-share model to ensure digital divide issues are catered for
- Traffic doubling every 12 months but subscription income declining 3% annually









GÉANT is a trusted European Commission (EC) partner in many global collaboration projects and initiatives through our special relationship with the European Union.





Network

The GÉANT network interconnects research, education and innovation communities worldwide, with secure, high-capacity networks.

We design, plan, build and operate the large-scale, high-performance GÉANT network that connects European NRENs to each other and the rest of the world for sharing, accessing and processing the high data volumes generated by research and education communities and for testing innovative technologies and concepts.



Interconnecting Europe's NRENs over a 500Gb highly-resilient pan-European backbone. NRENs serve 50 million users at 10,000 institutions across Europe. Network services: IP, Point-to-Point Services, VPN, Testbeds, performance monitoring







Network

A separate ultra-high-speed internet, only for research & education

Robustness

Over 1,000 terabytes of data are transferred every day via the GÉANT IP backbone.

Total reliability

100% average monthly access availability.



"Today it would not be possible to work without the network that GÉANT and the NRENs have provided." CMS experiment, Large Hadron Collider (LHC)

Efficient operations

The dedicated GÉANT Operations Centre ensures 99% of cases are reported within 15 minutes of any outage being detected, leading to rapid resolution.

Services

A wide range of services including IP and dedicated circuits, testbeds and virtualised resources, authentication and roaming, monitoring and troubleshooting, advisory and support services.





GÉANT develops the specialist services members need to support researchers, educators and innovators – at national, European and international levels.

GÉANT's portfolio of advanced services covers:



Network centric services







Storage and clouds



Real-time communications



Professional services





Network Services

GÉANT operates an advanced, high-performance network supporting Europe's NRENs with cost-effective, highly available, high-capacity services customised for and dedicated to research and education

GÉANT network services

GÉANT IP – Ultra-high performance uncontended IP connectivity at up to 2x100Gbit/s

GÉANT VPN – Layer 3 VPN services for NRENs and institutions supporting private networking needs

GÉANT Point-to-Point – High performance dedicated connectivity up to 100Gbit/s for the most demanding applications

GÉANT Open – Allows NRENs and approved commercial organisations to exchange connectivity in a highly efficient and flexible manner

eduroam - Seamless WiFi access around the world



Availability Targets 99.999% - 27 seconds downtime/month 99.99% - 4.5 minutes/month 99.4%* - 4 hours/month



MD-VPN

The GÉANT Multi-Domain Virtual Private Network (MD-VPN) provides an end-to-end international network service that enables scientists all over Europe to collaborate via a common private network infrastructure.

MD-VPN can be used for connectivity between clusters, grids, clouds and HPC (high-performance computing) centres, allowing them to form virtual distributed resources for third-party research projects.

MD-VPN offers fast delivery of VPNs to end users and so can be used in a variety of ways, from a long-term infrastructure with a high demand for intensive network usage to quick point-to-point connections for a conference demonstration.

L3 VPN

The GÉANT L3-VPN service provides NRENs with the backbone infrastructure to enable custom VPN services for their users across the GÉANT backbone.







GÉANT Plus

GÉANT Plus allows national research and education networking (NREN) organisations to request point-to-point Ethernet circuits between end-points at GÉANT PoPs (points of presence). Circuits can be established to any European NREN.

GÉANT Lambda

GÉANT Lambda provides full wavelengths at up to 100Gbps to support NREN users with particularly demanding network requirements. The service provides transparent 10Gbps, or 100Gbps wavelengths between GÉANT PoPs.

GÉANT Bandwidth on Demand

GÉANT Bandwidth on Demand (BoD) is a flexible network option for situations where users need to reliably transfer large data sets for short periods of time between two end points, with guaranteed bandwidth. The service is offered collaboratively by GÉANT and participating European NRENs, delivering a seamless user experience from order to delivery.





Facilitating open collaboration across the globe

Protocol

GÉANT Open is protocol neutral at the network layer and allows each participant to connect to the exchange at between 1Gbps and 100Gbps

VLAN connectivity

Connections can be logically subdivided into separate VLANs allowing the participant to simultaneously connect with many other members of the exchange

GÉANT network interconnectivity

Participants can also apply to make connections from GÉANT Open through the GÉANT network allowing onward connectivity to organisations that are unable to connect directly to GÉANT Open

International connectivity

GÉANT Open is able to support both European and worldwide interconnects



Network Performance and Management

Supporting High Performance Networking

perfS**O**NAR

- Network performance monitoring
- Joint venture with Internet2, ESnet and Indiana University
- Over 1650 measurement points deployed globally
- Helping measure and diagnose performance issues for the R&E community
- A world-wide Open Community for Performance Enhancement Response Teams,
- A virtual community covering performance issues for R&E networks



GÉANT CERT

Pan-European Computer Security Incidence Response Team coordination and a suite of network security tools (Distributed Denial of Service (DDOS) attack mitigation tools etc.)





Supporting users and enabling secure access to services



eduroam - secure global roaming access service <u>250+ million authentications per</u> <u>month</u> in 89 territories

eduGAIN eduGAIN - interconnects identity federations around the world, simplifying access to content, services and resources ~ 3500 identity providers accessing services



AARC project – collaborating with e-infrastructures, research collaborations, libraries & federations to share policies, architectures, training materials & pilots that avoid re-inventing the authentication & authorisation wheel



REFEDs – supporting identity federations worldwide



Trusted Introducer – services for security and incident response teams
Certificate Service – delivering cost-effective digital certificates.
In partnership with **Odigicert**







Free secure Wifi provided by NRENs between campuses.

A global network of users across 80 territories. More than 2 billion international authentications and counting

A worldwide success story

From its early beginnings as a joint venture between a few European universities to today – with millions of users in more than 80 territories worldwide, eduroam has been an amazing success story and an

example of research and education collaboration.





www.eduroam.org



ReduGAIN

Enabling secure Single Sign On services to global research and educational resources

Federated identities enable users to access a wide range of services using a single account sign-on managed by their 'home' institution

- Improves access
- Improves security
- Reduces management overhead and costs.



April 2017: 43 Federations active 5 Federations with voting rights in process of joining 3244 entities (50% growth)







Avoids re-inventing the AAI wheel, so researchers can focus on research.



What is AARC? - 2 min video

- 20+ project partners
- Address needs of e- and researchinfrastructures
- Engage through
 - <u>Community Engagement Forum</u>
 - Bridge Group
- Defined Blueprint Architecture
- 18+ technical <u>Pilots</u>
- Recommendations, best practices & <u>Policies</u> including:
 - <u>Sirtfi</u>
 - <u>Snctfi</u>
- **Toolkits of materials** (training, leaflets,FAQs, technical information etc.) for
 - Infrastructures
 - <u>Libraries</u>
 - More to come...





AARC and eduGAIN

eduGAIN has helped many collaboration communities

to interconnect and access / share resources but many collaborations don't have an AAI solution, or theirs can't interconnect through eduGAIN

AARC is creating a common AAI framework for research and collaboration communities that should work for everyone:

- One blueprint architecture
- One set of policies
- One set of training resources
- Working with research collaborations to pilot and improve technical and policy aspects



Relationship between the AARC blueprint architecture, eduGAIN and the GÉANT network.





Cloud Services

Cloud services can improve the service NRENs and Institutions offer their users

Increased range

Reduced costs (changing from CapEx to RevEx)

Increased flexibility and scalability

The area has huge opportunities but some risks

Supplier lock-in

Data security

Unplanned costs

https://clouds.geant.org/

GÉANT uses its skill and experience to help NRENs understand and navigate this new territory







Google

Microsoft

A growing resource for the research and education community, with a structured listing of service providers and cloud services. It provides a quick and easy guide to clarify the capabilities of providers and helps in the procurement of cloud services









Users we work with







Social Sciences, Arts and Humanities

Life Sciences High-Energy Physics and Astronomy

Earth

Sciences and

Observations



Future

Internet

Projects



E-Infrastructures







Scientific user groups we liaise with

Physics sciences High-energy physics (LHC, BELLE II, CERN, etc.) Neutrino observation (KM3NET)





Astronomy and Earth observation Earth observation (EUMETSAT, COPERNICUS) Radio-astronomy (eVLBI, SKA, etc.) Satellite operations (ESOC)

E-Infrastructures (EGI, EUDAT, PRACE, HelixNebula)



Future Internet projects (XiFi, Confine, SmartFire, etc.)

Life sciences Genomics (Elixir, EBI, EMBL) Biolmaging





- The GÉANT community's flagship conference
- regular attendance of over 650 participants from all across the world
- bringing together decision makers, networking and collaboration specialists, and identity and access management experts from all major European networking and research organisations, universities, worldwide sister institutions, as well as industry

representatives

www.geant.org/TNC



So International collaborations and partnerships







www.eumedconnect3.net

Scope

Regional network for the Mediterranean since 2004 – now in its third phase Phase 3: 2011-2014, extended until end 2019

Partners

Managed by **GÉANT**



- Regional partner ASREN (The Arab States Research and Education Network)
- 5 EU NRENs (CY, ES, FR, GR, IT) ٠
- Beneficiaries: Jordan, Lebanon and Palestine

Project update

- Lebanon connected for first time in 2016 and recently upgraded to 320Mbps, NREN being formed
- Jordan link connects SESAME to CERN via ASREN and GÉANT, NREN being re-connected
- Palestine interested in re-connection •
- DG NEAR increased EC funding to 60% ٠







Eastern Partnership - EaPConnect



Scope

€13M (95%) EU funding from DG NEAR, July 2015 to 2020

- Connectivity & equipment procurements
- Service portfolio & competency growth
- Knowledge transfer & outreach events

Partners

- Beneficiaries: IIAP NA RA (Armenia), IIT of ANAS (Azerbaijan), UIIP NASB (Belarus), GRENA (Georgia), RENAM (Moldova) & URAN (Ukraine)
- Associates: AARNet, BREN, DFN, ESnet, GARR, LITNET, PSNC, RoEduNet, REANNZ

Conference

- 2nd Eastern Partnership E-infrastructures Conference (EaPEC 2017) in Minsk, 27-28 September 2017
- 2nd regional Enlighten Your Research call in progress record response with 30+ entries









www.africaconnect2.net

Scope Connecting the R&E communities across Africa and interconnecting them with GÉANT.

€20M EU funding for 3.5 years (from June 2015)

Partners

- UbuntuNet Alliance: Eastern & Southern Africa Cluster 1
- WACREN: West & Central Africa Cluster 2
- ASREN: North Africa Cluster 3
- **GÉANT**: Administrative (Clusters 1, 2) + Coordination
- EU NRENs (CY, ES, FR, GR, IT, PT) also supporting
- Beneficiaries: 30 African NRENs

Project update

- Tendering underway for Clusters 2 and 3
- Regional partners working with AfriGEOSS to support Earth observation programmes across Africa
- Regional partners participating in NSF-funded NEAAR project to improve connectivity with North America
- Planning started for project continuation beyond November 2018











https://caren.geant.org

Scope

Regional network for Central Asia since 2010 2 previous phases 2010 - 2015 3rd phase (CAREN3) resumed in June 2016 up to 2019 €10M EU funding up to 2019

Partners

- Managed by GÉANT
- Initial beneficiaries: Kyrgyzstan and Tajikistan
- Kazakhstan, Turkmenistan and Uzbekistan also eligible, subject to financial agreements between their governments and the EC

Project update

- Ring of 1 Gbps circuits within the region connecting Kyrgyzstan and Tajikistan with GÉANT operational since April 2017
- CAREN Cooperation Center (CAREN CC) established
- 2nd CAREN Regional Conference (CRNC2017) held in Bishkek in April 2017









www.redclara.net

Connects 12 Latin American NRENs

10Gbps interconnection with GÉANT

Funded via NREN membership.

• Previously co-funded by DG-DEVCO ALICE and ALICE2 projects (2003-2013)

Efforts underway to procure & deploy:

- Long-term high-capacity transatlantic connectivity Europe and Latin America
- 100Gbps RedCLARA backbone







ANA is a collaborative effort of GÉANT, Internet2, CANARIE, Indiana University, NORDUnet and SURFnet to provide multiple, diverse links to support North America-European research.

Provides 400Gbps on diverse paths:

- 100Gbps between Ney York and Paris, funded by GÉANT
- 100Gbps between Amsterdam and Montreal, funded by NORDUnet and SURFnet
- 100Gbs between Washington and London, funded by Internet2 and CANARIE
- 100Gbps between London and New York, funded by the US NSF NEAAR project led by Indiana University

ESnet funds 340Gbps of capacity between Europe and North America (Boston-Amsterdam; New York-London; Washington DC-Geneva. The links provides back-up for ANA collaboration connectivity.















GEANT has also developed strong bilateral relations with the region's major NRENs

CERNET and CSTNET

- 10Gbps direct EU-China connectivity jointly provided by GEANT (GN4) and CERNET
- Working with CERNET and CSTNET to promote EU-China collaborations (e.g radio-astronomy, meteorology, genomics TNE etc)

NKN

- 10Gbps peering in Amsterdam
- Seeking to strengthen EU/India user collaborations (e.g. high energy physics)











Asia Pacific – Asi@Connect



Scope

TEIN (Trans-Eurasia Information Network): R&E connectivity across Asia-Pacific and to Europe 3 EU-funded phases (TEIN2-4) from 2005 to 2016

New project phase: Asi@Connect (2016-2021; €20M EU-funding)

Partners

- GÉANT set up and ran until 2012 when handed over to TEIN* Cooperation Centre (TEIN*CC) based in Korea
- TEIN*CC supported by GÉANT (ongoing consultancy agreement)
- Beneficiaries: TEIN connects over 55 million users in **20 countries and economies**

Project update

- Major emphasis on applications support, community building and public internet deployment in remote area
- Mechanism of Call for Proposals
- Developing closer links with the APAN community







NII/SINET

20Gbps peering in London, GEANT providing equipment housing

MOU renewed this year with increased technical & marketing collaboration and user support (e.g. ITER, BELLE II)

Further connectivity upgrades planned

NICT

New MOU signed 2016, extending technical co-operation (e.g. SDN, federated identity technologies,)

SingAREN

Co-funding a 10Gbps TEIN link to GÉANT

Planning London equipment housing for Singaporean HPC community

User collaborations (e.g. supercomputing)





















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- European Space Agency/JAXA collaboration
- Hayabusa2 (JAXA) and BepiColombo (ESA) satellites
- Establish a redundant and diverse p2p circui







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South America









- Transmission layer based on Infinera DTNx Platform
- IP/MPLS layer based on Juniper MX series Platform
- Single vendor solution
- High backplane capacity
- High space and power requirements
- No data-plane programmability







XTC-10

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Infinera















No Disaggregation: Entire transport network acts as one element



Fully Disaggregated: Everything is a separate network element



Partially: Transponding is one element, OOLS is second.















Open Line System



Infrastructure sharing between GEANT and NRENs Lowering the cost of sharing capacity over fibre





- Support (sustainable!) exponential growth in network traffic
- Scale faster
- Reduce space and power costs
- Flexibility and ease of deployment
- Agnostic infrastructure

Open, disaggregated networks are essential to meet the requirements of the R&E community





ご清聴ありがとうございました (Thank you!)

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